

REMARKS

Please find attached hereto, a Petition and Fee for a Two-Months Extension of Time.

Please find attached hereto, a fee for two (2) independent claims in excess of three.

Applicants reaffirm the selection of group I, claims 1-5, and 7 made by Applicants' representative in a telephone conversation with the Examiner on April 1, 2003.

Claims 1-5 and 7-17 are pending in the application. This Amendment amends claims 1-5 and 7, cancels claim 6, which is withdrawn from present consideration without prejudice or disclaimer, and adds new claims 8-17. No new matter is added to amended claims 1-5 and 7 or to new claims 8-17. Claims 1-5 and 7 are amended to merely clarify the subject matter of the claim and in no way narrow the scope of the claims in order to overcome the prior art or for any other statutory purpose of patentability.

Notwithstanding any claim amendments of the present Amendment or those amendments that may be made later during prosecution, Applicants' intent is to encompass equivalents of all claim elements. Reconsideration in view of the foregoing amendments and the following remarks is respectfully requested.

Claims 1 and 7 stand rejected under 35 U.S.C. §102(b) as anticipated by U.S. Patent No. 5,603,772 to Ide. Claims 2-5 stand rejected under 35 U.S.C. §103(a) as unpatentable over Ide.

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

The claimed invention, as defined in claim 1, is directed to a temperature control method of controlling a heating apparatus, including at least two heating zones, so as to adjust temperatures detected at predetermined locations to a target temperature, where the method comprises detecting temperatures at the predetermined locations, a number of which is larger than a number of the at least two heating zones and at least one of which is located in each of the at least two heating zones, and controlling the heating apparatus in such a manner that the target temperature, detected at the predetermined locations, falls between a maximum value and a minimum value, in which power supplies of the at least two heating zones are independently adjusted.

The claimed invention, as defined in claim 4, is directed to a temperature control

method of controlling an apparatus, which includes a process chamber, a heating apparatus including at least one heating zone for heating a treatment target provided in the process chamber, and first temperature detectors, at least one of the first temperature detectors provided for each of the at least one heating zone for detecting heating temperatures provided by the heating apparatus at first predetermined locations, in which a power supply of the at least one heating zone is independently adjusted, in which the heating apparatus is controlled on a basis of first detected temperatures detected by the first temperature detectors and a first target temperature for the first detected temperatures, and in which a plurality of second temperature detectors are disposed at second predetermined locations, a number of which is larger than that of the at least one heating zone and which are closer to the treatment target than the first predetermined locations, where the method comprises comparing second detected temperatures detected by the second temperature detectors with a second target temperature to obtain corrective values for the first target temperature, and correcting the first target temperature by the corrective values.

The claimed invention, as defined in claim 7, is directed to a method of manufacturing a semiconductor device, in which a target substrate is subjected to a heating process by controlling a heating apparatus, including at least two heating zones, in such a manner that temperatures detected at predetermined locations equal a target temperature, where the method comprises detecting temperatures at the predetermined locations, a number of which is larger than a number of the at least two heating zones and at least one of which is located in each of the at least two heating zones, and controlling the heating apparatus in such a manner that the target temperature, detected at the predetermined location, falls between a maximum value and a minimum value, in which power supplies of the at least two heating zones are independently adjusted.

A conventional soaking control method for a thermal treatment apparatus comprises dividing substrate area of the thermal treatment apparatus into a plurality of heating zones, setting target temperatures for all of the heating zones, detecting temperatures of the divided substrate area by temperature detectors, such as, cascade thermocouples located at the periphery of a furnace, and providing heating control, which uses the detected temperatures so that treated substrates arranged in the furnace may be treated at a target temperature.

An aspect of the present invention is to provide a temperature control method, a

thermal treatment apparatus, and a method of manufacturing a semiconductor device, which can simply, accurately, and promptly, adjust temperatures of all areas of a treatment substrate to a target value, while quickly and accurately reducing resulting errors.

II. THE PRIOR ART REJECTIONS

The Ide Reference

Nothing in Ide discloses, teaches or suggests the features of the present invention. In particular, Ide does not describe detecting temperatures at predetermined locations, a number of which is larger than a number of heating zones. For example, Fig. 4 of Ide discloses six independent temperature control systems, which have one temperature sensor each.

Referring to the temperature control system of the heater element 22a of the heater group 220, the temperature sensor 21a of the sensor group 210 is connected with the controller unit 23a of the controller group 230. The controller unit 23a is connected with the power supply unit 24a of the power supply group 240. The power supply unit 24a is connected with the heater element 22a of the heater group 220 to control the heater. As a convenience to the Examiner, the other temperature control systems have the relationships as above, which are summarized below.

	First Group	Second Group	Third Group
Upper Direction	T/C 210 - 21a	211 - 21a	21n - 21a
	PID 230 - 23a	231 - 23a	23n - 23a
	Power 240 - 24a	241 - 24a	24n - 24a
	Heater 220 - 22a	221 - 22a	22n - 22a
Lower Direction	T/C 210 - 21b	211 - 21b	21n - 21b
	PID 230 - 23b	231 - 23b	23n - 23b
	Power 240 - 24b	241 - 24b	24n - 24b
	Heater 220 - 22b	221 - 22b	22n - 22b

As seen from above, the number of heater zones in Ide corresponds to the number of temperature sensors.

In contrast, the present invention comprises "detecting temperatures at predetermined locations, a number of which is larger than a number of heating zones, in which power supplies are independently adjusted, as recited in claims 1, 4, and 7.

Accordingly, in the present invention, even if a temperature difference occurs in one heating zone, the predetermined and controlled temperature can be achieved. The same effect can be achieved in the case of using a plurality of heating zones.

Further, the present invention includes controlling a heating apparatus in such a manner that a target temperature, detected at the predetermined locations, falls between a maximum and a minimum value, as recited in claims 1 and 7. Therefore, control of heating at the predetermined locations is further improved.

Furthermore, according to the invention of claim 4, no second temperature detector needs to be provided in the actual process, thereby preventing the adverse effects of the provision of the temperature detectors on the treatment target (Specification, page 12, third paragraph).

Claim 1 recites at least the features of "detecting temperatures at said predetermined locations, a number of which is larger than a number of said at least two heating zones and at least one of which is located in each of said at least two heating zones."

Similarly, claim 4 recites at least the features of "wherein a plurality of second temperature detectors are disposed at second predetermined locations, a number of which is larger than that of said at least one heating zone."

Similarly, claim 7 recites at least the features of "detecting temperatures at said predetermined locations, a number of which is larger than a number of said at least two heating zones and at least one of which is located in each of said at least two heating zones."

Ide discloses a plurality of temperature sensor groups 210 to 21n, each of the plurality of temperature sensor groups 210 to 21n having two sensor positions 26a and 26b located on the rectangular sensor brackets 260 to 26n within the outer periphery of the semiconductor wafers. Thus, the number of sensors at position 26a for the plurality of sensor groups 210 to 21n equals the number of sensors at position 26b for the plurality of sensor groups 210 to 21n.

Therefore, Ide does not teach or suggest at least the features of "detecting temperatures at said predetermined locations, a number of which is larger than a number of said at least two heating zones and at least one of which is located in each of said at least two heating zones" as recited in claim 1 and similarly recited in claims 4 and 7.

For at least the reasons outlined above, Applicants respectfully submit that Ide does

not teach or suggest every feature of claims 1, 4 and 7. Accordingly, Ide fails to anticipate, or to teach or suggest, the subject matter of claims 1, 4, and 7, and claims 2, 3, and 5, which depend from claims 1 and 4 under 35 U.S.C. §102(b) and 35 U.S.C. §103(a), respectively. Withdrawal of the rejection of claims 1 and 7 under 35 U.S.C. §102(b) as anticipated by Ide and the rejection of claims 2-5 under 35 U.S.C. §103(a) as unpatentable over Ide is respectfully requested.

III. CONCLUSION

In view of the foregoing, Applicants submit that claims 1-5 and 7-17, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 9/8/03

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